

PRAIRIE CROSSING HOMES

Building America houses that use half as much energy



Buildings for the 21st Century

Buildings that are more energy-efficient, comfortable, and affordable... that's the goal of DOE's Office of Building Technology, State and Community Programs (BTS). To accelerate the development and wide application of energy efficiency measures, BTS:

- Conducts R&D on technologies and concepts for energy efficiency, working closely with the building industry and with manufacturers of materials, equipment, and appliances
- Promotes energy/money saving opportunities to both builders and buyers of homes and commercial buildings
- Works with State and local regulatory groups to improve building codes, appliance standards, and guidelines for efficient energy use
- Provides support and grants to States and communities for deployment of energy-efficient technologies and practices

Although they use only half as much energy as other houses in the same area of northwest Chicago, the 315 homes being built here through the U.S. Department of Energy's Building America program cost little or no more to build. New building methods make the difference.

The Prairie Crossing homes in Grayslake, Illinois, cost approximately the same as competitive houses of the same size with the same basic features, yet use approximately 50 percent less energy to heat and cool. This clear incentive to buyers plagued by the rising cost of energy comes with a price tag comparable with that of a less efficient home—thanks to an innovative “whole house” concept.

The idea, developed by the Building America program, is to look at the whole picture, not just individual pieces of the jigsaw puzzle. Building America has brought together four teams drawn from all sectors of the housing industry: architects, engineers, real estate developers, financial backers, building materials suppliers,

and builders. The teams create designs that incorporate from the start the best combination of construction features to cut costs and energy use. Through the Building America program, DOE's Office of Building Technology, State and Community Programs (BTS) is helping to produce energy-efficient, environmentally sensitive, affordable, and adaptable houses on a community scale.

The systems engineering approaches used to develop the Prairie Crossing designs make maximum use of the interaction between the building envelope and its heating and cooling system. The major premises are that a house should be designed around its mechanical system, and that its shell should fit around the living space tightly enough to retain the heated or cooled air. As a result, the size and cost of the heating and cooling system are significantly decreased and its efficiency increased. The costs of a more efficient envelope are offset by those of the smaller system.



HOUSE CHARACTERISTICS

- 2-story with optional screened porch
- Average area: 2692 sq. ft.
- Bedrooms: 3
- Baths: 2½
- Living room, family room, dining room, eat-in kitchen



PRAIRIE CROSSING HOUSES
INCORPORATE A SYSTEM OF
COST-SAVING TRADE-OFFS

The Prairie Crossing homes, built by the Building Science Consortium through the Building America program, demonstrate new framing and insulation methods that effectively increase energy efficiency and decrease costs. Using conventional wood studs, but 2x6s instead of 2x4s, and setting them 24 instead of 16 inches apart, allows for thicker insulation. The labor costs are significantly lower, as 30 percent fewer pieces have to be assembled. The result? Thicker walls that provide 60 percent more thermal resistance at less cost than standard construction.

To construct a tight envelope, the homes use a new double air-barrier system, whereby the drywall, glued to the framing, provides a second air-tight wall. Rigid

foam sheathing is glued to the outside of the framing to seal the first wall, eliminating the need for polyethylene vapor barriers and housewrap. An interior air flow retarder system is built into the walls. High-performance glazing on the windows completes the leakproof shell. Low-emissivity (low-e) glazing costs more, but is paid for by the savings from the smaller mechanical system.

All the ductwork is placed within this envelope, so the building shell stays tightly sealed. Heated or cooled air flowing through the ducts conditions the interior as it travels, instead of being wasted. The tight building envelope allows for a smaller, less expensive, higher-efficiency heating system. To increase comfort levels, a controlled mechanical ventilation system in the homes allows occupants to regulate air flow.

Prairie Crossing homes incorporate features that do away with many of the warranty and callback issues that increase the cost of standard construction. These mostly concern leaks or moisture, or comfort issues. Moisture can condense within a structure wherever cold surfaces occur, so using fewer studs decreases the incidence of thermal bridging, allows for increased insulation, and reduces the potential for condensation. In addition, fewer studs means more flexibility and less cracking in the drywall, a major cause of warranty complaints. Prairie Crossing homes use up to 30 percent fewer framing members and attach drywall with innovative clips that result in floating corners and significantly less cracking.

INCREMENTAL COST
SUMMARY

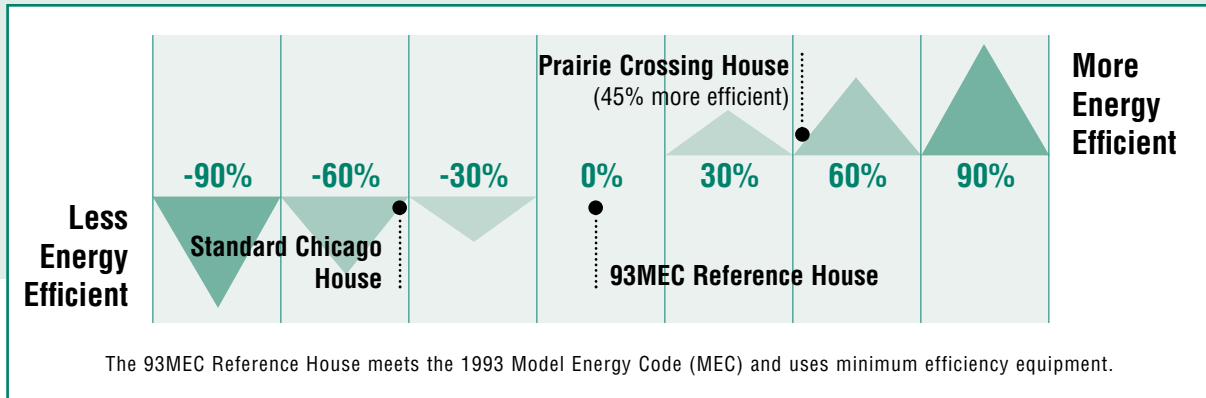
A far more efficient house at nominal extra cost—to achieve Building America results in a typical Chicago house layout, these costs and savings are incurred.

Features	Difference in Cost
Advanced framing: 2x6s with R-19 in place of 2x4s with R-13	-\$500
R-7 insulating sheathing, taped, in place of OSB and housewrap	+\$300
Cost saving from not using OSB and housewrap	-\$300
High-performance windows	+\$500
Interior air flow retarder	+\$200
No polyethylene vapor barrier	-\$100
Basement insulation	+\$600
Controlled ventilation system	+\$100
Power-vented gas water heater*	+\$300
90-percent-efficient condensing gas furnace**	+\$500
Downsizing of AC unit by 1 ton	-\$700
Total Incremental Cost	+\$900

* Prairie Crossing houses feature a power-vented water heater, which allows greater flexibility in placing the unit. A direct-vent water heater could achieve the same energy performance for half the cost.
** These houses can achieve efficiency improvements of 40 percent without the additional cost of a 90-percent-efficient condensing gas furnace. The use of this furnace boosts efficiency improvements toward 50 percent.

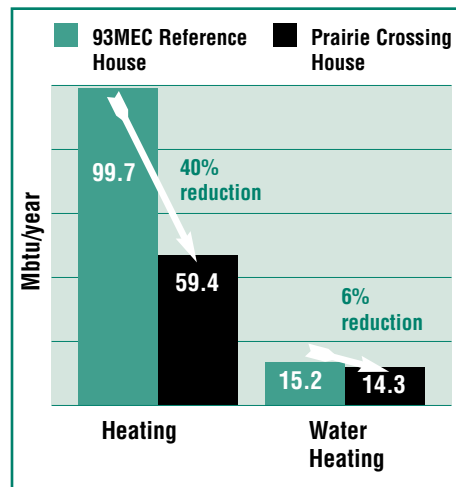
PRAIRIE CROSSING

PERFORMANCE COMPARISON



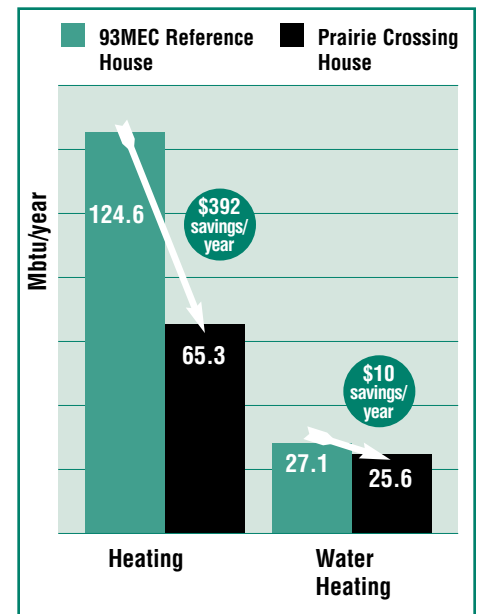
At Prairie Crossing, the Building America team has demonstrated the benefits of applying sustainable energy principles to building design and construction. Reduced energy consumption, increased affordability, and greater comfort make the homes immediately attractive to buyers. Comparable building costs appeal to construction professionals, and reduced environmental impact, more jobs, and resource conservation appeal to everyone.

HEATING AND COOLING LOADS



The energy-efficient features of the Prairie Crossing homes considerably reduce the annual estimated heating and cooling loads compared to a reference house that meets the 1993 Model Energy Code (93MEC).

ENERGY CONSUMPTION AND COSTS



The energy efficiency measures applied to the Prairie Crossing houses have reduced energy consumption and costs significantly. Cost savings estimates assume natural gas at \$0.6615/therm.

PRAIRIE CROSSING

For more information,
contact:

Building America

George James,
Program Manager
202-586-9472
George.James@hq.doe.gov
www.eren.doe.gov/
buildings/building_america

Building Science Consortium

Betsy Pettit, Team Leader
978-589-5100
betsy@buildingscience.com
www.buildingscience.com

Energy Efficiency and Renewable Energy Clearinghouse (EREC) 1-800-DOE-3732

Or visit the BTS Web site at:
www.eren.doe.gov/buildings

Written and prepared for
the U.S. Department of
Energy by:

Office of Building Technology, State and Community Programs

NOTICE: Neither the United States government nor any agency thereof, nor any of their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States government or any agency thereof.

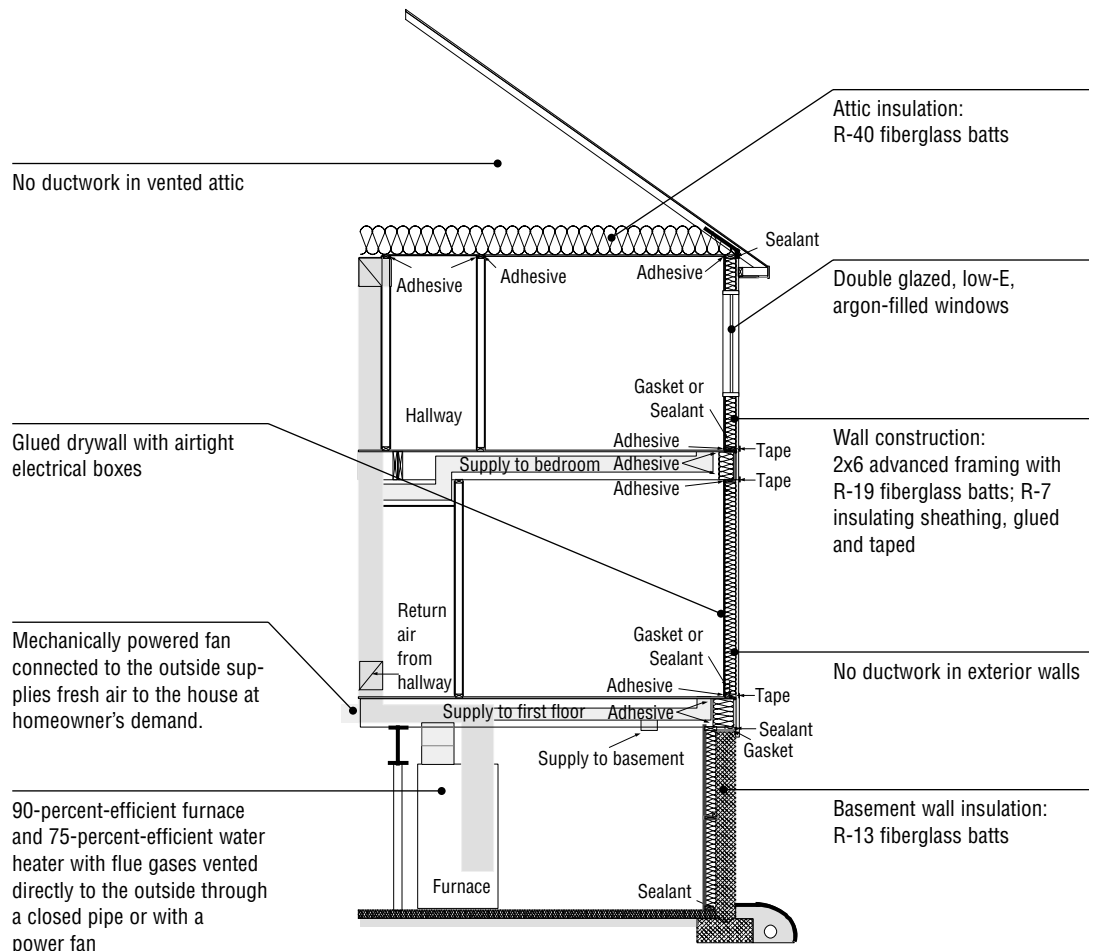
ENERGY FEATURES

✓ BUILDING ENVELOPE

- Ceiling/roof: Truss with R-40 insulation batts, with vented assembly
- Walls: 2x6 advanced framing, with R-19 batts instead of standard R-13, R-7 insulating sheathing, and interior air-flow retarder
- Basement: R-13 full height fiberglass batt insulation
- Windows: Double-glazed, low-e, argon-filled glass
- Total envelope leakage: Less than 2.5 sq. in. per 100 sq. ft. of building envelope area at 10 Pascals

✓ MECHANICAL SYSTEM

- Furnace: 90-percent-efficient condensing gas furnace; single unit, within envelope
- Hot water tank: 75-percent-efficient power-vented gas water heater
- Ductwork: Leakage less than 5 percent of total rated flow at high speed at 25 Pascals; all ductwork within conditioned space
- Ventilation: Supply fan ventilation system with distributed exhaust; independently controlled



Printed with a renewable-source ink on paper containing at least 50% wastepaper, including 20% postconsumer waste.

February 1999 DOE/GO/10099-738